Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

A CROSS-SECTIONAL ASSESSMENT ON SOLID WASTE MANAGEMENT PRACTICES IN MUBENDE MUNICIPALITY, UGANDA.

Benedict Kalyango[1], Fortunate Lujjimbirwa[1, 2, 3], Simon Peter Kaweesa[4, 5], Amos Ronald Kalukusu[1, 2, 6], Martin Odoki[1, 2, 7]**

[1]Department of Natural Resource Management, School of Sciences, Nkumba University, P.O. Box 237, Entebbe, Uganda
[2]Department of Applied Sciences, School of Sciences, Nkumba University, P.O. Box 237, Entebbe, Uganda
[3]Department of Biomedical Laboratory Sciences, Faculty of Health Sciences, University of Kisubi P.O. Box 182, Entebbe, Uganda
[4]Department of Pharmacology and Therapeutics, School of Medicine, King Ceasor University, P. O. Box 88, Kampala, Uganda
[5]Department of Pharmacology and Toxicology, School of Pharmacy, Kampala International University Western-Campus, P.O. Box 71, Bushenyi, Uganda
[6]Department of Public Health, School of Medicine, King Ceasor University, P. O. Box 88, Kampala, Uganda
[7]Department of Microbiology and Immunology, School of Medicine, King Ceasor University, P. O. Box 88, Kampala, Uganda

ABSTRACT.

Background:

Mubende Municipality is a developing municipality located in Uganda's central region. As a result of urbanization, the human population has increased. The rise in population due to industrialization and farming has resulted in increased municipal solid waste (MSW) accumulation. The purpose of this study was to assess solid waste management practices in Mubende municipality, Mubende District.

Methods:

A cross-sectional descriptive design was employed in the study. The South Division, West Division, and East Division are the three municipal divisions where the study was conducted. A simple random sampling technique was used in the investigation to select 400 respondents at random from each of the three divisions. The study's data was collected through observations, interviews, and questionnaires. Data were analyzed using descriptive statistics.

Results:

The sources of MSW in Mubende District were 50.5% households, 21.5% markets, 13.25% commercial areas, 11.5% industries, and 3.25% institutions. Organic waste accounts for the majority of solid waste generated in Mubende (34.50% agricultural waste and 23.0% food waste). Food scraps from households made up 23.00% of municipal solid waste. Plastics and polythene are also considered solid waste accounting for 16.75% and 13.75% respectively. The most common methods of waste management were landfills 45% and burning 27.50%.

Conclusion:

Organic waste accounts for the majority of solid waste generated in Mubende Municipality. Mubende Municipality's preferred solid waste management methods are landfilling, open burning, composting, and indiscriminate dumping. However, these methods are frequently mismanaged, as evidenced by the visible heaps of rotting garbage and scattered and uncollected solid waste.

Recommendation:

Mubende Municipality officials should consider building and maintaining solid waste collection points to prevent waste from spreading throughout open spaces, streets, and water streams. This will reduce the amount of solid waste dispersed and the resulting unsanitary conditions at central collection sites.

Keywords: *Solid waste management, Municipal solid waste, Waste management practices, Waste collection, Waste disposal.*
Submitted: 2024-04-27 Accepted: 2024-05-07

Corresponding author: Martin Odoki
Email: modoki@nkumbauniversity.ac.ug
Department of Applied Sciences, School of Sciences, Nkumba University, P.O. Box 237 Entebbe, Uganda

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

INTRODUCTION.

Most processes will inevitably produce waste or unnecessary or undesirable byproducts. Every year, the world produces 7-9 billion tonnes of trash (Wilson & Velis, 2015). Depending on the reporting standard, commercial and industrial wastes may be included in the particular category of waste from households known as municipal solid waste (MSW) (Wilson & Velis, 2015).

Two billion tonnes of waste were produced in 2016, of which MSW made up half. But given its effects on the environment at the local, regional, and global levels; its proximity to people and possible health consequences; and its potential for recovery through circular economy supply chains, it merits special attention (Kaza et al., 2018).

Rapid urbanization, rapid economic development, changes in human lifestyle, and rapid population growth have increased the quantity and complexity of solid waste generated, which has become a critical issue in developing countries. Nonetheless, it is believed that the current methods of managing Municipal Solid Waste (MSW), particularly those related to collection, processing, and disposal, are ineffective. These nations are consequently dealing with a growing number of environmental and health-related issues (Abubakar et al., 2022). Communities have been compelled by the absence of well-established MSW management systems to engage in open burning without taking precautions against air and water pollution, as well as to illegally dump waste on open fields, roadsides, and riverbanks.

It has been established that the unlawful disposal of MSW causes several diseases. People who live in areas with inadequate waste management have often experienced malaria, diarrhea, and severe respiratory infections. People who use MSW-contaminated water for food, drink, irrigation, or bathing are exposing themselves to various toxins and disease-causing organisms (Debrah et al., 2021; Tsydenova et al., 2018). Living near a landfill can also cause respiratory problems, allergies, gastrointestinal problems, skin, nose, and eye irritation, exhaustion, headaches, and psychological problems. High concentrations of various organic and inorganic components, which are readily broken down by a variety of microorganisms, are typically found in municipal waste. The anaerobic generation of byproducts from municipal wastes, such as ammonia, hydrogen sulfide, volatile organic compounds, and organic sulfur compounds, has a detrimental effect on locals' health. Exposure to the numerous pollutants produced by uncontrolled MSW incineration can have a detrimental impact on residents' mental, physical, and emotional well-being. These pollutants include carbon dioxide, carbon monoxide, particulate matter, dioxins, furans, ash, metals, and organic compounds (Debrah et al., 2021).

One of the biggest issues facing Ugandan cities and all of East Africa's cities is how to handle the growing volume of solid waste. This issue appears to be particularly serious in the municipality of Mubende, mostly as a result of insufficient waste collection and disposal. Waste collection within a municipality is typically the responsibility of the municipal council. The primary causes of inadequate waste collection are fewer working staff members than needed, unfavorable health outcomes, and a higher rate of absenteeism among working staff members in municipal councils. This problem worsens when inadequate resources and subpar infrastructure facilities are combined.

Due to the aforementioned factors, neither the government nor any private businesses provide waste collection services to urban residents in nearly all of the municipality's divisions. Consequently, people throw their waste into channels, other water sources, roadsides, abundant lands, forestry, etc. because it becomes a major issue for urban residents with limited space to dispose of their waste.

Since obtaining municipal status, the population of Mubende municipality, which consists of three divisions, seventeen (17) municipal wards, and seventy-five municipal cells, has increased. Ineffective collection and disposal cause a host of issues for the environment and public health, including air and water pollution, flooding, erosion, the spread of skin and respiratory diseases, and viral infections (Debrah et al., 2021; Tsydenova et al., 2018). The unresolved solid waste problem is directly impacted by low budget allocation and the absence of a national policy for solid waste management. To encourage all the parties involved in solid waste management to contribute effectively, a well-established national policy is required.

The generation and management of solid waste in urban areas is a major issue for nearly all municipalities in most developing countries. Solid waste generation, storage, collection, transportation, processing, and disposal are not performed to an appropriate standard in Mubende municipality and district. Roads, open spaces, residential areas, water sources, and occasionally drainage channels are all filled with uncollected waste from homes, businesses, construction sites, institutions (schools and hospitals), demolitions, and agricultural produce. In Mubended District, 98% of households live in filthy and indecent conditions, according to the National Population and Housing Census 2014 reports (UBOS, 2017). The insufficient collection of solid wastes in Mubende municipality exposes the urban population to health risks and adverse environmental effects. Despite current efforts to curb the problem, the inefficiencies in solid waste management are growing more complex. Therefore, there was a need for a study to comprehensively assess Mubende municipality's solid waste management system. This included identifying waste sources, characterizing waste

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

types, and evaluating current collection and disposal practices. Such a comprehensive assessment provides valuable insights to improve the overall effectiveness and sustainability of waste management.

METHODS.

Study design.

This study employed a descriptive cross-sectional design, utilizing quantitative methods to gather and analyze data on solid waste management practices in Mubende Municipality, Uganda. This approach provided a snapshot of the current waste management situation at a specific point in time.

Study setting.

The study was conducted in Mubende Municipality, Uganda. Mubende Municipality is one of the four constituencies that comprise Mubende district which consists of 75 municipal cells, 17 municipal wards, and 3 divisions make up the Mubende municipality (South, East and West divisions) (Figure 1). It has about 23,463 households and a land area of 454 square meters (NPHC, 2014). Data was collected between February 2023 and July 2023.

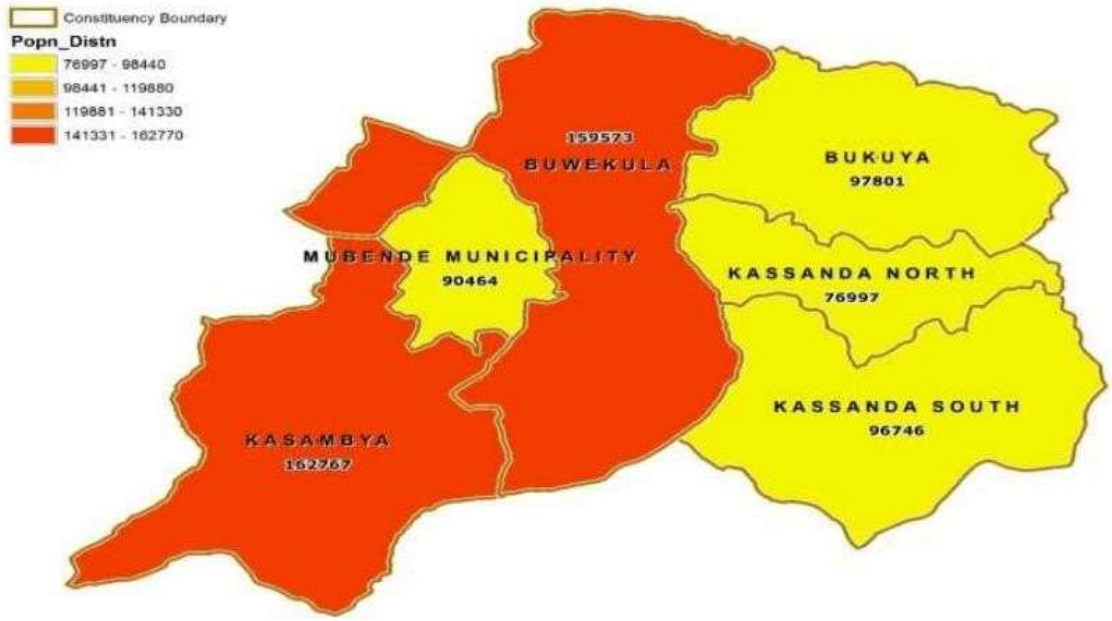

Figure 1: Map showing the location of Mubende Municipality.

Study population.

The estimated population of the municipality in 2021 was 127, 600, of which 64100 were men and 63500 were women (UBOS, 2021).

Study participants.

The study involved residents from various neighborhoods in Mubende Municipality, encompassing both urban and peri-urban areas. Researchers utilized a combination of observations, interviews, and questionnaires to gather data from the participants.

Study bias.

To minimize potential selection bias, the study employed a simple random sampling technique. This approach ensured that all residents of Mubende Municipality had an equal chance of being selected, aiming to achieve a representative sample that reflects the characteristics of the entire population. To further address potential measurement and information bias, the study adopted a mixed methods approach. This involved combining self-reported data from surveys with direct observations of waste disposal practices in various areas of Mubende Municipality. By triangulating these data sources, the researchers gained a more comprehensive understanding of waste management behavior. This approach reduced reliance on potentially

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

subjective self-reported information and provided a more objective picture of waste disposal practices across the municipality.

Study size.

Using Yamane's formula (Adam, 2020), n=N/1+N (e)2, a sample of 400 respondents was obtained. Where N is the population size, n is the sample size, and e represents the acceptable error. Mubende Municipality has a population of 127,600 (UBOS, 2021), with an allowable error of 0.05. The sample size was calculated as: n=N/1+N (e)2, n=127,600/1+127,600 (0.05)2, n=399. A simple random sampling technique was used in the investigation to select 400 respondents at random from each of the three divisions.

Selection criteria.

Inclusion criteria.

The study recruited participants residing within Mubende Municipality boundaries to gain firsthand insights into local waste management practices. Residents who were included in the study met the following criteria: Adults aged 18 or older, ensuring legal capacity for informed consent and maturity to understand the survey. Permanent residents, capturing established waste management behaviors within the municipality and excluding temporary disposal habits. Willing and able to provide informed consent, prioritizing participants who understood the research and voluntarily agreed to participate. Able to understand and respond to the survey instrument in the chosen language (English or Luganda), guaranteeing clear communication and accurate data collection.

Exclusion criteria.

The study excluded residents who were not permanent residents of Mubende Municipality, individuals under 18 years of age, those who were unwilling or unable to provide informed consent, and anyone with cognitive impairments that prevented them from understanding or responding to the survey instrument.

Data Collection.

A questionnaire was designed and pre-tested by research experts and approved by the university supervisor before being distributed to respondents. The University issued a letter of authorization to allow the study to take place, which was then presented to the municipal council mentioned in the case study. Data were collected through questionnaires and interviews. In this regard, questionnaires were logically drafted and distributed to households, municipal council employees, and residents near the Kalagala landfill. The data's quantification was reflected in its presentation, such as percentages used to create charts, graphs, and tables.

Statistical methods.

The study used simple random sampling to select the study participants and appropriate statistical tests to explore interaction effects. The IBM Statistical Package for the Social Sciences (SPSS) version 20 was used to analyze the data after it was entered into Excel. The frequency of the primary sources and major waste types produced, as well as an evaluation of solid waste management techniques, were ascertained using descriptive statistics. To ensure a comprehensive analysis of Mubende Municipality's solid waste management practices, the study addressed missing data through two methods: excluding participants with incomplete information and employing statistical imputation to estimate missing values. This two-pronged approach mitigated potential biases and ensured a robust dataset for identifying clear trends and patterns within the collected data.

Ethical consideration.

The study was carried out according to the guidelines stated in the Mildmay Uganda Research and Ethics Committee Manual, 2021. Throughout the data collection process, ethical considerations were taken into account. Each chosen respondent was first made aware that the study was voluntary and that only those who gave verbal and written consent were included. The study rigorously obtained informed consent from participants before data collection. This likely involved a clear explanation of the study's purpose, potential risks and benefits, and participants' rights to withdraw. By ensuring participants understood and voluntarily agreed to participate, the study fostered trust and ethical research practices. Secondly, each respondent received a thorough explanation of the study's goals and an introduction before being assigned to a fieldwork assignment. Thirdly, to protect respondents from harm, all research instruments included an introduction that guaranteed the anonymity of participants. The study prioritized ethical research practices by ensuring confidentiality for all participants and treating everyone involved with respect.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

RESULTS.

Demographics/Socio-economic Characteristics of respondents.

A large number of participants in the study were residents 223 (56%), traders 133 (33%), and market vendors 44 (11%). According to the findings, males 224 (56%) outnumbered females 176 (44%). 268 (67%) of the participants had attended a primary school, 44 (11%) had reached a tertiary level, and the remaining 88 (22%) had studied up to the secondary level.

Additionally, the study revealed that 356 respondents (89%) had lived in the study area for more than a year, compared to 44 respondents (11%) who had done so for less time. The West and East Divisions had 267 (66.75) study participants and the South had 133 (33.25%) study participants (Table 1).

Table 1: Demographic Characteristics of respondents in Mubende Municipality, Uganda.

Variable	Category	South Division	West East Division	Total N (%)
Municipal division	Municipal division	133	267	400 (100)
Sex	Male	74	150	224 (56%)
	Female	59	117	176 (44%)
Respondent	Trader	44	89	133 (33%)
	Market vendors	15	29	44 (11%)
	Resident	74	149	223 (56%)
Premises	Private owner	44	89	133 (33%)
	Tenant	45	89	134 (34%)
	Public	44	89	133 (33%)
Duration of stay	Below one year	15	29	44 (11%)
	Over one year	118	238	356 (89%)
Level of education	Primary level	89	179	268 (67%)
	Secondary level	29	59	88 (22%)
	Tertiary	15	29	44 (11%)

Sources of municipal solid wastes.

This study showed that the sources of MSW in Mubended District were in the following order: Households account for 50.5%, followed by markets (21.5%), commercial areas (13.25%), industries (11.5%), and institutions (3.25%) (Table 2).

Table 2: Sources of municipal solid waste in Mubende Municipality, Uganda

Source	South Division	West Division	East Division	Total	Total Percentage
Markets	28	18	40	86	21.5%
Households	65	48	89	202	50.5%
Commercial areas	20	12	21	53	13.25%
Institutions	5	2	6	13	3.25%
Industries	15	10	21	46	11.5%
Total	133	90	177	400	100

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

Types of municipal solid waste.

Agriculture wastes are the most common type of municipal solid waste, according to 138 (34.50%) respondents. Food scraps from households made up 23.00% of municipal solid waste. Plastics and polythene are also considered solid waste, according to 67 (16.75%) and 55 (13.75%), respectively. Metal composition is too low, according to 5 respondents (1.25%). Hospital waste (medical waste) and other wastes such as paper, glass, and rags (old clothes) made up 10.75% of the municipal solid waste composition (Table 3).

Table 3: Types of municipal solid waste in Mubende Municipality, Uganda.

Major types	South Division	West Division	East Division	Total	Percentage
Plastics	30	10	27	67	16.75%
Polythene	18	17	20	55	13.75%
Metal	3	0	2	5	1.25%
Agriculture waste	50	33	55	138	34.50%
Foods (leftovers)	27	20	45	92	23.00%
Other waste	5	10	28	43	10.75%
Total	133	90	177	400	100.00%

Solid waste management practices.

Respondents 310 (77.5%) did not use waste containers at their respective locations, while 90 (22.50%) did and used them effectively. Most of the respondents, 300 (75%), had nothing to reuse from the waste generated, as opposed to 100 (25%) who said that some waste generated at their workplaces could be reused. According to the table, the Municipal Council is the most effective waste collection organization 230 (57.50%). Individually, 170 (35%) of respondents collected waste from their workplaces. Of the respondents, 200 (50%) did not know how often waste is collected from their locations in a given week, while 150 (37.5%) agreed that it happens more than twice but not every day. Twice a week was approved by the remaining 50 (12.50%). In contrast to their counterparts 90 (22.50%) who were prepared and willing to pay for the services in the future, the majority of respondents, 310 (77.5%), had no intention of paying for waste collection services. A large proportion of respondents, 180 (45%), believed that waste collected was taken to a landfill, 90 (22.5%) to collection centers, and 110 (27.50%) to a pit for burning. The remaining 20 (5%) had no idea where solid waste was taken after collection from their locations. According to 290 (72.50%) respondents, hard plastics would be good to sort for recycling. 57 (14.20%) were unfamiliar with sorting. For polythene, 50 (12.5%) and the remaining 3 (0.80%) were for glass. Sorting waste before disposing of it is very important, according to the majority of respondents 201 (50.20%), while the remaining 199 (49.80%), did not agree. Of the respondents, 280 (70%) thought there were multiple ways to reduce the amount of waste produced, while the remaining 120 (30%) disagreed (Table 4). Sorted plastics and containers at St. Peter's Vocational Training Institute; the red container is for inorganic materials such as plastics and polyethylene, and the green container is for organic materials; these were clearly labeled (Figure 2), and Figure 3 shows an MSW dumped in the open space along Mubende-Fortportal highway.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

Table 4: Solid waste management practices in Mubende Municipality, Uganda.

SN	Area in question	Response	South division	West division	East Division	Total	Percentage
1	Waste Containers in use	Yes	30	21	39	90	22.50%
		No	103	69	138	310	77.50%
2	Reuse of waste	Yes	33	23	44	100	25
		No	100	67	133	300	75%
3	Waste collectors	self	57	39	74	170	42.5%
		Private	0	0	0	0	0%
		Municipal	76	51	103	230	57.50%
4	Pay for waste collection	Yes	30	21	39	90	22.50%
		No	103	69	138	310	77.50%
5	Collection centers	Landfill	60	40	80	180	45%
		Centres	30	20	40	90	22.50%
		Burning pit	37	24	49	110	27.50%
		Don't know	7	4	9	20	5%
6	Collection frequency	twice	16	12	22	50	12.50%
		>twice	50	33	67	150	37.50%
		Daily	0	0	0	0	0%
		Don't know	67	45	88	200	50%
7	Waste reduction	Yes	93	62	125	280	70%
		No	40	28	52	120	30%
8	Sorting waste	Yes	67	46	88	201	50.20%
		No	66	44	89	199	49.80%
9	Waste for recycling	Hard plastics	96	66	128	290	72.50%
		Polythene	17	11	22	50	12.50%
		Glass	1	1	1	3	0.80%
		Paper	0	0	0	0	0%
		Don't know	19	12	26	57	14.20%

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

Figure 2: Sorted plastics and containers at St. Peter's Vocational Training Institute.

Figure 3: Municipal solid waste dumped in the open space along the Mubende-Fortportal highway.

DISCUSSION.

In interpreting the study's findings on waste sources, households emerged as the dominant contributor of Municipal Solid Waste (MSW) in Mubende District, responsible for over half (50.5%) of the total waste. Markets followed at 21.5%, with commercial areas (13.25%), industries (11.5%), and institutions (3.25%) generating progressively less waste. This suggests that residential waste generation is a significant concern in Mubende District.

Furthermore, based on the survey results, agricultural waste appears to be the most common type of municipal solid waste in this area. Respondents indicated that agricultural waste makes up over a third (34.5%) of the total waste, followed by food scraps from households at 23%. This suggests that organic waste is a major component of the municipal solid waste stream. Plastics and polythene are also significant contributors, with 16.75% and 13.75% respectively. Metal waste seems to be much less common, at only 1.25%. The remaining category, labeled "other wastes" and encompassing hospital waste, paper, glass, and rags, constitutes 10.75% of the total.

Finally, the interpretation of the study shows a critical need for improved waste management practices in Mubende. Residents lack essential resources, with most not using bins (77.5%) and rarely reusing waste (75%). There's also confusion about collection frequency, with half unsure (50%). The Municipal Council collects waste (57.5%), but residents are unwilling to pay (77.5%). Despite uncertainty about disposal methods (landfills 45%, collection centers 22.5%, burning pits 27.5%, unsure 5%), 50.2% recognize the value of sorting waste, especially hard plastics (72.5%). This highlights the potential for significant improvement through better infrastructure and education initiatives.

Sources of solid waste generated in Mubende Municipality.

The sources of MSW in Mubended District as demonstrated by this study were in the order of households 50.5%, markets 21.5%, commercial areas 13.25%, Industries 11.5%, and Institutions 3.25%. This study showed that household waste was the main source of waste, and this specific finding is consistent with reports from Fadhullah et al. (2022). According to Fadhullah et al. (2022), household waste from residential areas includes glass, paper, plastic, rags, metal, and food waste which is one of the primary sources of MSW. Household waste is one of the solid wastes that Kota Bharu, which comprises 15 sub-districts including Panji, manages. Given that Panji has more people living in it than any other subdistrict, evaluating household SWM among the residents is essential to understanding their awareness and practices when it comes to developing a successful SWM plan. The size of the family, their income (Sujauddin et al., 2008), their level of education

(Ekere et al., 2009), and the location of the household (Abdullah et al., 2017) are some of the important factors influencing the efficacy of SWM. Matsumoto (2011) reported that household characteristics influence recycling behavior and that sociodemographic conditions differ across municipalities lends credence to this factor. The quantity of municipal waste and how it is managed are also influenced by socioeconomic status and housing characteristics (Emery et al., 2003). Therefore, while developing an appropriate waste management program, it is crucial to understand the requirements and features of different households.

This study further still shows that a significant amount of waste is generated from the market. This finding is comparable to the reports of Pheakdey et al. (2022). Their research indicates that waste from central city local markets is either disposed of at the designated public space and then scooped up by workers with shovels, or it is stored in hauling containers provided by waste collection companies that can be mechanically loaded into collection trucks and transported to landfills. Additionally, this study showed that the MSW in Mubende District is largely contributed by commercial areas, which are also significant avenues. This finding is in line with a previous study by Akenji et al. (2020). According to their research, there are three categories of solid waste in Cambodia: household, commercial, and industrial, and hazardous wastes (including medical waste). Municipal solid waste (MSW) integrates wastes from residential and commercial properties (Gupta et al., 2015), including those produced by people's homes, markets, restaurants, shops, hotels, offices, street sweepings, and other sources (Pheakdey et al., 2022). As a result of people migrating to cities in response to rapid industrialization and urbanization in search of better employment opportunities, access to higher education, and improved health care, waste generation has become unpredictable. Accurate data on MSW generation is hard to come by and is based primarily on the population data for the majority of the nation and a constant generation rate. In Mubende Municipality, organic waste makes up the majority of the waste generated by homes, businesses, and markets.

The main types of solid waste generated in Mubende Municipality.

Organic waste makes up the majority of the solid waste produced in the municipality of Mubende (34.50% of which is agricultural waste and 23.0% is food waste). This finding is in agreement with a previous study by Fadhullah et al. (2022) and Okot-Okumu & Nyenje (2011). Okot-Okumu & Nyenje (2011) reported that waste in Uganda is primarily biodegradable (78%). According to a related study conducted in Indonesia by Aprilia et al. (2013), recyclable inorganic wastes like plastic, paper, and cardboard make up the largest portion of household waste, followed by kitchen waste. This finding is in line with earlier studies conducted by the World Bank. These results are in line with the World Bank (2018), which shows that middle- and low-income countries produce 53% and 57% of the food waste and 57% of the green waste, respectively, with the proportion of organic waste rising as levels of economic development fall.

Based on the collected data, the predominant waste types in the study area are organic wastes, which are mainly composed of agricultural wastes. The bulk of the organic wastes are observed to consist primarily of vegetable remains, potato peelings, and banana peelings, all of which are often heavy and difficult to handle. Municipal solid waste is typically composed of a variety of materials, each with distinct physical and chemical characteristics. According to a related study conducted in Mityana Municipality by Bbira & Ameria (2020), a significant portion of household solid waste in developing nations like Uganda is made up of organic, biodegradable wastes like leaves, fruit and vegetable peelings, and food scraps. The composition and characteristics of waste produced in a given municipal area are influenced by several factors, including the type of waste collection system, sanitary facilities, income levels, food types available, food packaging, and the presence of livestock in a city. The results of this study are consistent with assessments of the solid waste produced in developing countries, which is mostly organic and poses a serious problem for waste management (Khan et al., 2022). Although industrialized nations produce large amounts of waste, they are distinguished by inorganic wastes like paper, boxes, and other types of packing materials, whose management practices are simpler than those for organic wastes (Peng et al., 2023).

The study attributes the high volume of waste and subsequent management issues to the type of solid waste generated. Nonetheless, since compostable waste can be used to grow plants, feed animals, and make fuel, it is essential to separate the various types of solid waste generated at the source to reduce the overall amount of waste to a level that can be transferred. Understanding the sources, types, and composition of MSW in each locality is crucial for managing it. Several crucial questions need to be addressed, including the quantity and rate of waste creation, the kinds and compositions of the waste, adjusting the rate of generation, and identifying the hazardous components.

Waste management practices.

The following were the observed methods for waste management (45%) landfill and (27.50%) burning. This current study revealed that landfilling contributed to 45%

of waste management practices. Due to the respondents' inadequate understanding of the critical significance of waste separation at the source generally, the amount of municipal solid waste being dumped in landfill sites is steadily rising, endangering the remaining landfill space more quickly than anticipated. Therefore, more focused and long-lasting public awareness campaigns combined with an enabling infrastructure are needed to shift residents' perceptions toward better waste separation at source rates to address this environmental issue in developing countries generally and in Mubende districts in particular. The results of the waste segregation efforts should also be highlighted, as well as how waste minimization in the first place and waste segregation at the source will benefit and improve households' standards of living or quality of life (Fadhullah et al., 2022; Mwanza et al., 2018).

There is only one landfill in the municipality, and it serves all three divisions and is situated in the east division at Kalagala. Some people deposit MSW at different collection centers because they are ignorant of the landfill or its significance. Some people decide to burn when they are unable to get to collection centers. After municipal officers collected their waste, other people were unaware of its whereabouts. Some facilities, like Mubende Regional Referral Hospital, use incineration. Before incineration, waste is immediately separated by installing collection bins of distinct colors for different types of waste, such as black for syringes, knives, and other sharp objects, blue for leftover patient samples, and green for decomposing waste (blood, and urine).

In areas with a high density of housing, open central collection sites are used; however, they are poorly maintained, resulting in unhygienic conditions. The main causes of all municipal waste being disposed of in open dumps, it was further noted, are a lack of financial resources and inadequate environmental education. The lack of resources and inadequate environmental education demonstrated in this study is in line with the previous findings by Fadhullah et al. (2022). Fadhullah et al. (2022) reported that insufficient funding, a labor shortage, and transportation are the main problems that contribute to the issue. Due to a lack of understanding of suitable waste handling techniques and the significance of correctly segregating garbage as proper waste handling begins at home, it was discovered that solid waste management in one of the rural areas of Kelantan is regarded as inefficient. This study has demonstrated that waste 27.5% of the respondents practice burning as a waste management practice. The practice of burning reported in this study is in line with previous reports by Fadhullah et al. (2022). The practice of burning may arise if they don't have containers, they might burn, bury the trash nearby, or take it elsewhere to be dumped. Households in Central Uganda without waste storage containers were found by (Mukama et al., 2016) to be keeping their wastes exposed outside the home. Permanent containers may need to be provided, and this may fall under the purview of the householder, the collection agency, or a public awareness campaign. This study found that because it was affordable and practical for the respondents, they gave open burning of solid waste a high priority. According to the study's findings, respondents who owned large tracts of land and engaged in urban farming used burning as a practice slightly outside the Mubende Town, whereas open dumping which is cheap and convenient but dangerous was used in the municipality's central area. All of the waste that has been collected is taken to a landfill by the municipal officials.

Dumping waste in the Mubende District landfill has resulted in littering the environment, which has become irritant and distressing. This finding is consistent with Ihuoma's (2012) previous report. According to Jazat et al. (2022), open waste dumping is a clear substratum for flies, insects, and rats that attract and reproduce putrescible components. Through contact with food and water, the flies can transmit diseases such as dysentery and diarrhea. Diseases such as salmonellosis, leptospirosis, and Lassa fever may be linked to the migration of filthy rats to neighboring houses in the vicinity of refuse (Jazat et al., 2022; Sangodoyin, 1993). Surface and groundwater were also contaminated by unhygienic waste disposal practices like defecating in streams and dumping trash in pits, rivers, and drainage channels (Sangodoyin, 1993). Abel (2007) bemoaned the lack of documentation regarding the volume and make-up of waste produced in Africa. He thought that this restricted the ability to manage waste effectively. Salami et al. (2019) made a convincing argument that waste management and control are necessary for society.

According to this study, which is consistent with a prior study by Maitlo et al. (2022), recycling of hard plastics accounts for (72.5%) of waste management practices. As previously reported by Abubakar et al. (2022), materials reuse and recycling contribute to waste reduction, pollution reduction, cost reduction, and green growth. Other waste management practices demonstrated by this study are; waste reduction (70%), landfilling (45%), open burning (27.5%), and use of waste containers (22.5%). The containers, infrastructure, and equipment required to provide SW collection service at the household level depend on the type of service. Systems that are based on the kind, volume, and frequency of collection of waste from sources other than households must be installed. It was challenging for many community members to dispose of their waste because they lacked waste containers. Receptacles for collecting waste were observed in establishments like schools, hospitals, and a few at market entrances.

The informal sector is primarily responsible for the limited amount of waste recycling that occurs. Similar findings

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

were reported by Doukali (2023), this could probably be because of the associated costs, recycling of municipal solid wastes is frequently developed by the informal sector and is infrequently supported by municipal authorities in developing countries. The Mubende Municipality may want to take this on as a major business venture in the future, though it may be a commercial undertaking. Given that recycling in Mubende Municipality is extremely low in comparison to waste production, it is necessary to support the development of recycling projects involving a variety of materials to improve solid waste management, conserve precious resources, and generate employment.

Mubende Municipality is the primary solid waste collector in the study area, using two trucks and tractors to service three divisions. No identified private operators were present. The reason is that private services only operate where customers can afford the costs of waste disposal, and the findings show that 310 respondents (77.5%) do not intend to pay for waste collection services. This finding is inconsistent with earlier studies. In Jimma town, 83.5% of residents (Mulat et al., 2019), 86.3% of Bahir Dar city residents (Tassie & Endalew, 2020), 78% of Addis Abeba residents(Dika et al., 2019), and 81.06% of Injibara town residents said they would be willing to support or pay for SWM services. However, there are a variety of sociodemographic, economic, attitude, and awareness-related factors that affect households' willingness to support and pay for solid waste management services. Previous studies have identified the following factors as determining willingness to pay: age, income, educational attainment, sex, awareness of the household regarding the risk associated with waste produced, ownership of the house, and the amount of waste generated (Kaso et al., 2022).

The results of this study indicate that the Mubende municipality can reduce waste by implementing source separation and other waste characterization initiatives. These efforts can also be bolstered by policies that align with sustainable waste management practices, as previously documented by Ratnasari et al. (2023). Given that the composition is primarily organic, composting processes can be implemented on a residential, community, and industrial scale for reuse and recycling in municipal settings. Vermicomposting is advised as a safe, doable, and straightforward way to stabilize organic waste in homes and communities without endangering the environment or public health (Saha et al., 2022). Large amounts of waste would be reused and diverted from landfills as a result of these practices.

Overall, reducing the amount of waste that is ultimately disposed of is the best practice for sustainable waste management in Africa. Large amounts of recyclable waste are nonetheless transported directly to the disposal sites because the majority of African nations lack official waste transfer stations. However, the greatest amount of effort must be made to increase recycling and lower the amount of waste that is disposed of. Increasing waste separation at the source could be the first step in this process, which would decrease the disposal of recyclable and reusable materials. To design circular economies for resource efficiency and effectively separate waste, it is necessary to treat waste as a resource. This necessitates the adoption of policies that allow for a transition from traditional waste management to integrated and comprehensive resource management (Aryampa et al., 2019; Wilts et al., 2016).

This study again indicates that the issue of inadequate resources for effective waste management is the ubiquitous challenge confronting Mubende municipality. This finding is in line with a previous study by Boateng et al. (2023). Also, this demonstrated that poor working conditions and unfavorable government laws are big challenges to waste management in Mubende Municipality.

CONCLUSION.

Organic waste accounts for 34.50% of the solid waste generated in the Mubende municipality, with food leftovers accounting for 23.0% of the total. The three most favored methods of managing solid waste in Mubende Municipality are open burning, landfilling, and careless dumping. But as the striking piles of decaying trash and uncollected solid waste show, these practices are frequently mismanaged. Because these organic materials serve as a breeding ground for disease and rodents, the presence of massive piles of solid waste poses serious risks to the environment and the community. Air pollution and chemical pollutants that enter the human food chain are unhealthy and cannot be removed without incurring significant costs once they have been absorbed into the soil through leaching.

Although not entirely, the waste at the generation sites was sorted. The Mubende Regional Referral Hospital, St. Peter's Vocational Training Institute, and Total Energies Petrol Station are just a few of the few recognized establishments that engage in sorting at the generation source. The lack of evidence of private provider services resulted in subpar and delayed solid waste management services. It is accurate to conclude from this study that the environment and public health are at risk due to the ineffective solid waste management practices used in the Mubende municipality.

LIMITATIONS.

The cross-sectional study design has inherent limitations. Causality; because the data was collected at a single point in time, the study cannot establish cause-and-effect relationships between variables such as waste generation and disposal practices. It can only recognize associations. Recall Bias: Participants may have difficulty recalling previous waste disposal behaviors, potentially biasing the

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 5 No. 6 (2024): June 2024 Issue
https://doi.org/10.51168/sjhrafrica.v5i6.1160
Original Article

data. Social Desirability Bias: Participants may be more likely to report environmentally friendly behaviors, even if they are not completely accurate. Selection Bias; while simple random sampling aims for representativeness, it may not fully capture the entire population, potentially leading to biased results. Generalizability: The findings from Mubende Municipality may not apply to other Ugandan municipalities with different demographics or waste management infrastructure. These limitations acknowledge that the findings may be biased or imprecise. Future research could address these limitations by using longitudinal studies to track behavior over time, memory aids to improve recall accuracy, and mixed methods approaches that combine surveys and observations.

RECOMMENDATIONS.

Mubende Municipality officials should use outreach initiatives and radio stations like Tropical and Heart FM to inform and encourage locals to sort their solid wastes at the source to reduce waste production. The enormous volumes of waste produced are difficult to handle and inconvenient. Sorted organic materials can be used as animal feed and a source of biogas, preventing them from entering the solid waste stream at the source and extending the landfill's life. This creates value addition for organic waste at the source, improves recycling efforts, and makes it easier to dispose of waste properly in the end. For sustainable solid waste management, clean environment education is essential because it fosters an attitude of environmental stewardship and raises people's awareness of the consequences of poor sanitation on their daily lives. Local communities will effectively participate in the construction of waste collection bays when they are made aware of the health and environmental risks associated with inadequate solid waste management. The Mubende Municipality's improved solid waste management depends on having enough money. However, since the consequences of inadequate solid waste management affect the entire population, it is important to discourage the tendency among some people to believe that the municipality is responsible for the collection and disposal of solid waste.

To prevent waste from being scattered throughout open spaces, streets, and water streams, Mubende Municipality officials should think about building solid waste collection points or providing enough containers for waste disposal and maintaining the areas surrounding them. This is because residents are more likely to dispose of waste outside of containers if they are unclean and obstructed in all divisions. By doing this, the amount of solid waste that is dispersed and the subsequent unsanitary conditions from the central collection sites will be reduced. To prevent health issues, however, sufficient municipal solid waste facilities should be accessible and properly managed. A sanitary landfill, which typically poses fewer health risks to people than open dumping, needs to be built in every division, but it shouldn't be built next to a community, a forest, a water source, or anywhere else that could harm the surrounding ecology. Open dumping has resulted in an unhealthy environment, as both the community and important respondents have reported. As a result, immediate action is required, and the best option is to construct a sanitary landfill. Personnel employed in the sanitary landfill ought to be appropriately outfitted and instructed.

The Kalagala dumping site should be transformed into a modern, sanitary landfill by applying a daily cover, building drainage channels around the site to collect runoff leachate, fencing the area to control accessibility, and regularly monitoring the facility's waste volumes, composition, methane gas production, surface and groundwater conditions, and drainage system condition. As one of the best practices, workers should also be protected by clean water, hygienic training, and personal protective equipment (PPE) to prevent injuries from sharp waste. Burning of waste at the dumpsite should be avoided because it is dangerous for the environment and public health. To do this, establish a dumpsite management team to oversee daily operations there. Additionally, instead of having individuals turn decomposed waste into manure and sell it to farmers, municipal trucks that transport waste can return the manure to predetermined locations where it can be purchased by customers, increasing municipal revenue.

To influence their behavior and attitudes toward environmental health, it is crucial that communities fully participate in solid waste management and receive environmental sanitation education. Stated differently, there is a need to strengthen and advance public-private partnerships. This will further encourage coordination and cooperation between NGOs, CBOs, and organizations in the public and private sectors. Additionally, it will guarantee community involvement in improving greener productivity and cleaner production. Institutions, businesses, homes, and vendors that use appropriate solid waste management techniques, such as reducing solid waste, sorting waste at the source, and properly using collection bins, should receive incentives from the municipality. The best environmental honor and an excellent way to promote appropriate solid waste management within the municipality is to award certificates of recognition to the winners of annual competitions for the best solid waste managers.

Financial, technical, human, and managerial resources were some of the notable important factors contributing to poor solid waste management in Mubende Municipality, along with a lack of solid waste facilities and community awareness. To move forward in solid waste management, it is recommended that municipal authorities advocate for

empowerment from the central government or seek alternative sources of funding for improved service delivery through engagements with various stakeholders such as private companies, institutional waste generators, and industrial residential waste generators. This can be accomplished by increasing awareness campaigns among small-scale investors in waste recycling.

Solid waste management options should be improved through increased research and development. Further research is needed to determine the impact of poor solid waste management, particularly plastic materials, on land quality and the health risks associated with their burning. It is widely believed that inhaling smoke from burning plastics causes cancer.

Policies and laws governing solid waste management should have valid justifications. Concerns have been raised about the dangers of uncontrolled solid waste dumping, which makes the area susceptible to communicable diseases, as well as the fact that the area is developing structurally and in terms of population. When the population continues to grow in the absence of laws governing sub-sectoral issues such as solid waste management, it may be impossible to reverse the environmental damage they have caused.

Even though the majority of respondents said they would not pay for waste collection, local officials should educate the public and, with mutual consent, impose a certain levy because doing so will increase revenue, which will then be used to support waste collection services in the municipality.

The amount of organic waste in MSW in Mubende Municipality is growing, so it is important to promote the 5R principle—Reduce, Recycle, Reuse, Recover, and Residual Management—to either eliminate or drastically reduce waste. It will also contribute to producing less waste.

It is recommended that the municipal authority expand the scope of waste collection throughout the municipality to improve efficiency and coverage. Early separation produces higher-quality, cleaner materials and saves money on disposal and transportation.

Lastly, to make planning easier, the municipality's health department should oversee the entire waste management process and maintain scientific records of all the elements involved. Once the community has been informed, allow the municipality to provide collection bins labeled with specific colors, such as red for non-organic waste, green for organic waste, and yellow for recyclables.

ACKNOWLEDGEMENT.

The authors are thankful to the Administrators of Mubende municipality for granting them the opportunity to collect data from the residents and facilities located in Mubende municipality, Uganda.

LIST OF ABBREVIATIONS.

n - Sample size
% - Percentage
CBOs - Community-Based Organizations
FM – Frequency modulation
KBMC - Kota Bharu Medical Centre
MSW - Municipal solid waste
NGOs - non-governmental organization
NPHC - National Population and Housing Census
PPE - Personal protective equipment
SPSS - Statistical Package for the Social Sciences
SWM – Solid waste management
UBOS - Uganda Bureau of Statistics

CONFLICTS OF INTEREST.

There are no conflicts of interest associated with this work.

AUTHORS' CONTRIBUTIONS.

This research was a collaborative effort by all authors. Benedict Kalyango, Fortunate Lujjimbirwa, Simon Peter Kaweesa, and Amos Ronald Kalukusu led data collection and statistical analysis, while the first author and Martin Odoki co-wrote the manuscript. All authors ensured the final manuscript's accuracy by reading and approving it.

SOURCE OF FUNDING.

There was no external funding. All funds invested in this work were privately sourced.

REFERENCES.

1. Abdullah, Z., Salleh, S., & Ku Ismail, K. B. I. (2017). Survey of household solid waste management and waste minimization in Malaysia: awareness, issues, and practices. *International Journal of Environmental & Agriculture Research (IJOEAR)*, *3*(12), 38–48. https://www.academia.edu/download/55415380/IJOEAR-DEC-2017-8.pdf
2. Abel, A. (2007). An analysis of solid waste generation in a traditional African city: The example of Ogbomoso, Nigeria. *Environment and Urbanization*, *19*(2), 527–537. https://doi.org/10.1177/0956247807082834
3. Abubakar, I. R., Maniruzzaman, K. M., Dano, U. L., AlShihri, F. S., AlShammari, M. S., Ahmed, S. M. S., Al-Gehlani, W. A. G., & Alrawaf, T. I.

(2022). Environmental Sustainability Impacts of Solid Waste Management Practices in the Global South. *International Journal of Environmental Research and Public Health*, *19*(19), 1–26. https://doi.org/10.3390/ijerph191912717

4. Adam, A. M. (2020). Sample Size Determination in Survey Research Sample Size Determination in Survey Research. *JSRR*, *26*(5), 90–97. https://doi.org/10.9734/JSRR/2020/v26i530263
5. Akenji, L., Bengtsson, M., Hotta, Y., Kato, M., & Hengesbaugh, M. (2020). Policy responses to plastic pollution in Asia. In *Plastic Waste and Recycling*. Elsevier Inc. https://doi.org/10.1016/b978-0-12-817880-5.00021-9
6. Aprilia, A., Tezuka, T., & Spaargaren, G. (2013). Inorganic and Hazardous Solid Waste Management: Current Status and Challenges for Indonesia. *Procedia Environmental Sciences*, *17*(81), 640–647. https://doi.org/10.1016/j.proenv.2013.02.080
7. Aryampa, S., Maheshwari, B., Sabiiti, E., Bateganya, N. L., & Bukenya, B. (2019). Status of waste management in the East African cities: Understanding the drivers of waste generation, collection and disposal and their impacts on Kampala City's sustainability. *Sustainability (Switzerland)*, *11*(19), 1–16. https://doi.org/10.3390/su11195523
8. Bbira, Y., & Ameria, N. (2020). Household Solid Waste Management in Urban Areas: A Focus on Mityana Municipality in Uganda. *International Journal of Innovative Research and Advanced Studies (IJIRAS)*, *7*(10), 77–96.
9. Boateng, S., Boakye-Ansah, D., Baah, A., Aboagye, B., & Kyeremeh, P. A. G. (2023). Solid Waste Management Practices and Challenges in Rural and Urban Senior High Schools in Ashanti Region, Ghana. *Journal of Environmental and Public Health*, *2023*, 9694467. https://doi.org/10.1155/2023/9694467
10. Debrah, J. K., Vidal, D. G., & Dinis, M. A. P. (2021). Raising awareness on solid waste management through formal education for sustainability: A developing countries evidence review. *Recycling*, *6*(1), 1–21. https://doi.org/10.3390/recycling6010006
11. Dika, G., Nemie, A., & Birhane, E. (2019). *Household's Willingness to Pay for Improved Solid Waste Management in Gulelle Sub City, Addis Ababa*. *6*(1), 1–7. https://doi.org/10.13189/eee.2019.060101
12. Doukali, I. (2023). *Enhancing Circular Economy and Waste Management in Zanzibar by Leveraging young entrepreneurship and innovation.Thesis, Master.* (Vol. 1, Issue 66).
13. Ekere, W., Mugisha, J., & Drake, L. (2009). Factors influencing waste separation and utilization among households in the Lake Victoria crescent, Uganda. *Waste Management*, *29*(12), 3047–3051. https://doi.org/10.1016/j.wasman.2009.08.001
14. Emery, A. D., Griffiths, A. J., & Williams, K. P. (2003). An in-depth study of the effects of socio-economic conditions on household waste recycling practices. *Waste Management and Research*, *21*(3), 180–190. https://doi.org/10.1177/0734242X0302100302
15. Fadhullah, W., Imran, N. I. N., Ismail, S. N. S., Jaafar, M. H., & Abdullah, H. (2022). Household solid waste management practices and perceptions among residents in the East Coast of Malaysia. *BMC Public Health*, *22*(1), 1–20. https://doi.org/10.1186/s12889-021-12274-7
16. Gupta, N., Yadav, K. K., & Kumar, V. (2015). A review of current status of municipal solid waste management in India. *Journal of Environmental Sciences (China)*, *37*, 206–217. https://doi.org/10.1016/j.jes.2015.01.034
17. Ihuoma, S. O. (2012). *Characterization and Quantification of Solid and Liquid Wastes Generated at the University of Ibadan, Ibadan, Nigeria [MSc. Thesis]*.
18. Jazat, J. P., Akande, J. A., & Ogunbode, T. O. (2022). State of solid waste disposal and suggested fixes for Iwo and Ibadan Metropolis, Nigeria. *Frontiers in Sustainability*, *3*. https://doi.org/10.3389/frsus.2022.1022519
19. Kaso, A. W., Hareru, H. E., Ashuro, Z., & Soboksa, N. E. (2022). Assessment of Households ' Willingness to Join and Pay for Improving Waste Management Practices in Gedeo Zone, Southern Ethiopia. *BioMed Research International*, *2022*, 1–20.
20. Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a Waste 2.0 Introduction -"Snapshot of Solid Waste Management to 2050." Overview booklet. *Urban Development Series*, 1–38. https://openknowledge.worldbank.org/handle/10986/30317
21. Khan, A. H., López-Maldonado, E. A., Khan, N. A., Villarreal-Gómez, L. J., Munshi, F. M., Alsabhan, A. H., & Perveen, K. (2022). Current solid waste management strategies and energy recovery in developing countries - State of the art review. *Chemosphere*, *291*.

https://doi.org/10.1016/j.chemosphere.2021.133088

22. Maitlo, G., Ali, I., Maitlo, H. A., Ali, S., Unar, I. N., Ahmad, M. B., Bhutto, D. K., Karmani, R. K., Naich, S. ur R., Sajjad, R. U., Ali, S., & Afridi, M. N. (2022). Plastic Waste Recycling, Applications, and Future Prospects for a Sustainable Environment. *Sustainability (Switzerland)*, *14*(18). https://doi.org/10.3390/su141811637
23. Matsumoto, S. (2011). Waste separation at home: Are Japanese municipal curbside recycling policies efficient? *Resources, Conservation and Recycling*, *55*(3), 325–334. https://doi.org/10.1016/j.resconrec.2010.10.005
24. Mukama, Ndejjo, Musoke, Musinguzi, Halage, A., Carpenter, & Ssempebwa. (2016). Practices-Concerns-and-Willingness-to-Participate-in-Solid-Waste-Management-in-Two-Urban-Slums-in-Central-Uganda2016Journal-of-Environmental-and-Public-HealthOpen-Access.pdf. *Journal of Environmental and Public Health*, *2016*, 7. https://www-scopus-com.bdigital.udistrital.edu.co/record/display.uri?eid=2-s2.0-84962800169&origin=resultslist&sort=cp-f&src=s&sid=296d3172fdb959bc04e0e663cff2fab9&sot=a&sdt=a&cluster=scoopenaccess%2C%220%22%2Cf&sl=93&s=TITLE-ABS-KEY%28composting+and+food
25. Mulat, S., Worku, W., & Minyihun, A. (2019). Willingness to pay for improved solid waste management and associated factors among households in Injibara town, Northwest. *BMC Research Notes*, *2019*, 1–6. https://doi.org/10.1186/s13104-019-4433-7
26. Mwanza, B. G., Mbohwa, C., & Telukdarie, A. (2018). Levers Influencing Sustainable Waste Recovery at Households Level: A Review. *Procedia Manufacturing*, *21*, 615–622. https://doi.org/10.1016/j.promfg.2018.02.163
27. Okot-Okumu, J., & Nyenje, R. (2011). Municipal solid waste management under decentralization in Uganda. *Habitat International*, *35*(4), 537–543. https://doi.org/10.1016/j.habitatint.2011.03.003
28. Peng, X., Jiang, Y., Chen, Z., Osman, A. I., Farghali, M., Rooney, D. W., & Yap, P. S. (2023). Recycling municipal, agricultural and industrial waste into energy, fertilizers, food, and construction materials, and economic feasibility: a review. In *Environmental Chemistry Letters* (Vol. 21, Issue 2). Springer International Publishing. https://doi.org/10.1007/s10311-022-01551-5
29. Pheakdey, D. V., Quan, N. Van, Khanh, T. D., & Xuan, T. D. (2022). Challenges and Priorities of Municipal Solid Waste Management in Cambodia. *International Journal of Environmental Research and Public Health*, *19*(14). https://doi.org/10.3390/ijerph19148458
30. Ratnasari, S., Mizuno, K., & Herdiansyah, H. (2023). Enhancing Sustainability Development for Waste Management through National – Local Policy Dynamics. *Sustainability*, *15*(6560), 1–24.
31. Saha, P., Barman, A., & Bera, A. (2022). Vermicomposting: A Step towards Sustainability. *Sustainable Crop Production - Recent Advances*, *1–16*(March). https://doi.org/10.5772/intechopen.102641
32. Salami, H. A., Adegite, J. O., Bademosi, T. T., Lawal, S. O., Olutayo, O. O., & Olowosokedile, O. (2019). A Review on the Current Status of Municipal Solid Waste Management in Nigeria: Problems and Solutions. *Journal of Engineering Research and Reports*, *February*, 1–16. https://doi.org/10.9734/jerr/2018/v3i416884
33. Sangodoyin, A. Y. (1993). Considerations on contamination of groundwater by waste disposal systems in Nigeria. *Environmental Technology (United Kingdom)*, *14*(10), 957–964. https://doi.org/10.1080/09593339309385370
34. Sujauddin, M., Huda, S. M. S., & Hoque, A. T. M. R. (2008). Household solid waste characteristics and management in Chittagong, Bangladesh. *Waste Management*, *28*(9), 1688–1695. https://doi.org/10.1016/j.wasman.2007.06.013
35. Tassie, K., & Endalew, B. (2020). management services and associated factors among urban households : One and one half bounded contingent valuation study in Bahir Dar Willingness to pay for improved solid waste management services and associated factors among urban households : One and on. *Cogent Environmental Science*, *6*(1807275), 1–26. https://doi.org/10.1080/23311843.2020.1807275
36. Tsydenova, N., Morillas, A. V., & Salas, A. A. C. (2018). Sustainability assessment of waste management system for Mexico city (Mexico)—based on analytic hierarchy process. *Recycling*, *3*(3), 1–18. https://doi.org/10.3390/recycling3030045
37. UBOS. (2017). Area Specific Profiles Mubende District. *National Population and Housing Census 2014*, *April*.
38. UBOS. (2021). *Uganda Bureau of statistics 2021 statistical abstract*.
39. Wilson, D. C., & Velis, C. A. (2015). Waste management - Still a global challenge in the 21st century: An evidence-based call for action. *Waste*

Management and Research, *33*(12), 1049–1051. https://doi.org/10.1177/0734242X15616055

40. Wilts, H., von Gries, N., & Bahn-Walkowiak, B. (2016). From waste management to resource efficiency need for policy mixes. *Sustainability (Switzerland)*, *8*(7), 1–16. https://doi.org/10.3390/su8070622
41. World Bank. (2018). *What a waste 2.0 A global snapshot of solid waste Management to 2050 report*.

Publisher details.

SJC PUBLISHERS COMPANY LIMITED

SJC Publishers Company Limited
TODAY AND TOMORROW

Catergory: Non Government & Non profit Organisation
Contact: +256 775 434 261 (WhatsApp)
Email: admin@sjpublisher.org, info@sjpublisher.org or studentsjournal2020@gmail.com
Website: https://sjpublisher.org
Location: Wisdom Centre Annex, P.o.Box 113407 Wakiso, Uganda, East Africa.